Nice Ride: Data-Driven Dynamics

Minneapolis Bike Share Company

Presented by

The Fundamental Group

Why We’re Here

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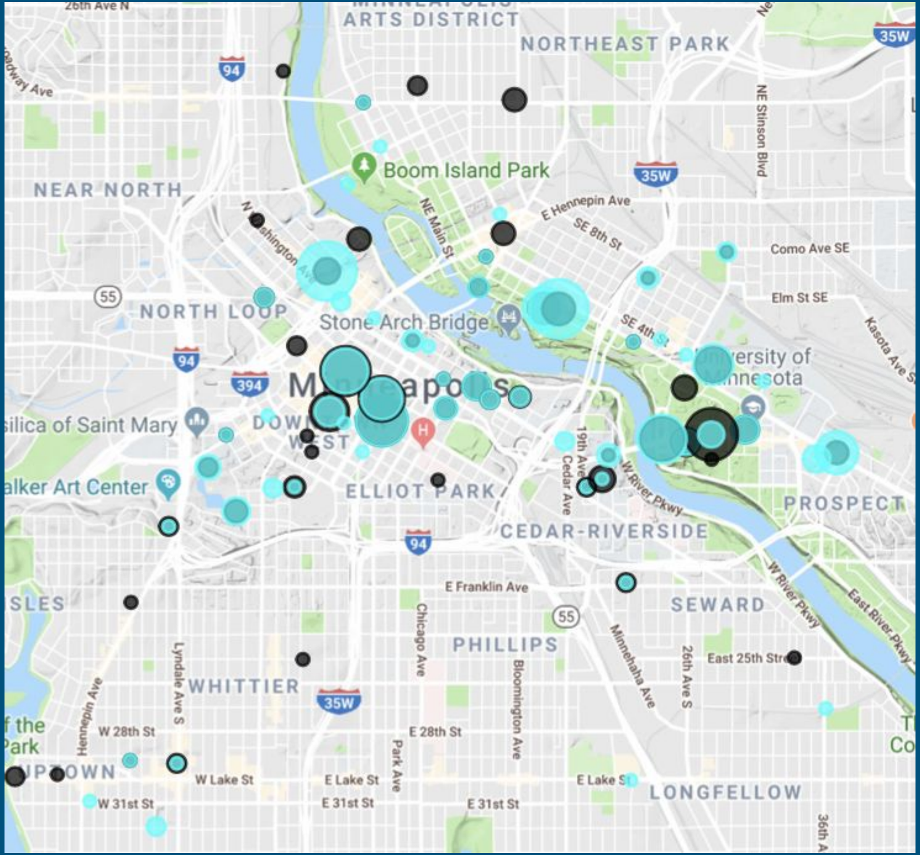
- Nice Ride has become an integral part of the the Twin Cities
- No one likes an empty or a full station
- We introduce automated, predictive, data-driven solutions to solve this problem

The Problem

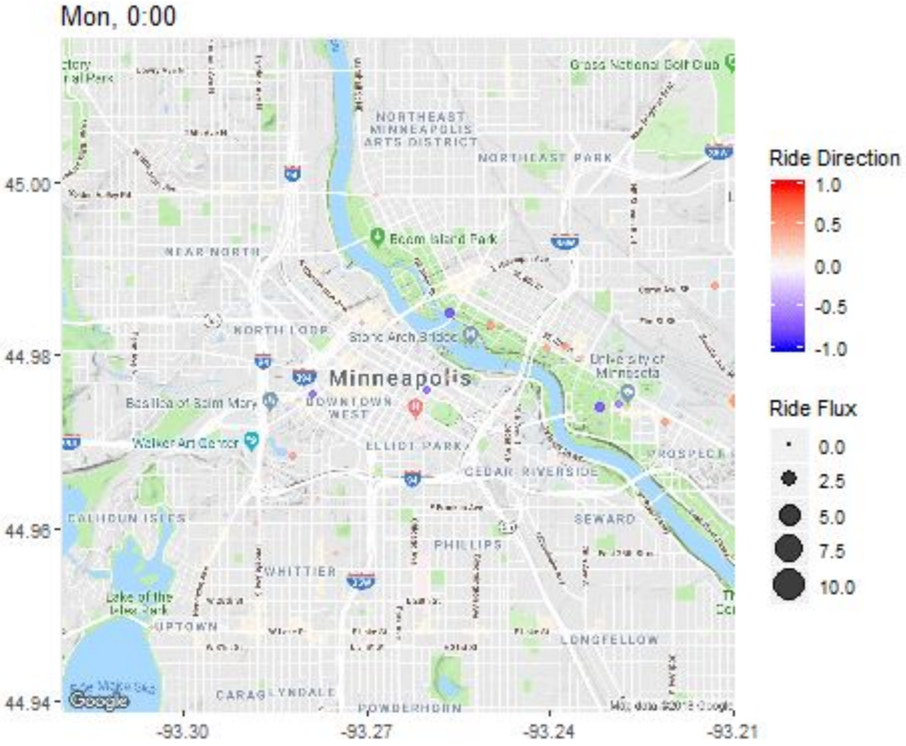
Certain stations lose or gain bikes quickly

- This leaves stations empty or full for long durations of time
- This can cause Nice Ride to lose customers

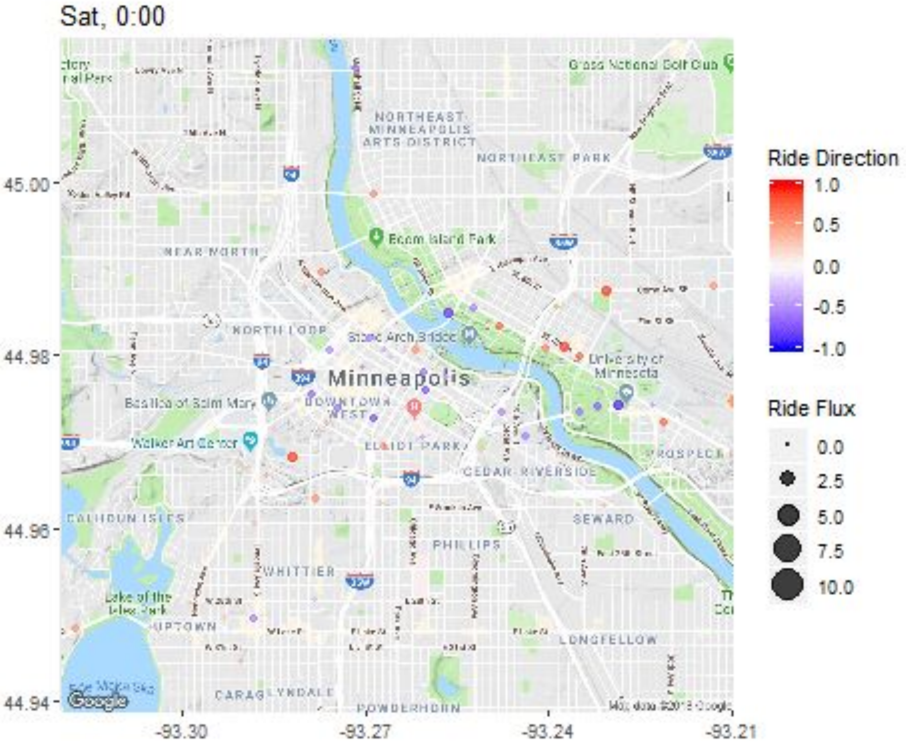


Blue - Bikes lost
Black - Bikes Gained

Average Ride Flow Patterns



Monday



Saturday

Our Goals

1. Predict the hourly change in bikes at each Nice Ride station

2. Predict overall system demand on any given day

3. Use this to develop a strategy for preventing the imbalance of bicycles to maximize customer satisfaction

Predicting Demand

1. **Hourly change in bikes per station**
(accurate within ±1.4 bikes per hour)

2. **Daily System Demand**:
Linear Regression Model

- Temperature
- Precipitation
- Average Wind Speed
- Season
- Thunder/Fog

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3. **Predict and prevent bike imbalance**

Current Situation

- Bike shuttling occurs, but is not automated
- Currently a couple of guys with trailers making up routes on the fly
- Reactive rather than proactive
- Many stations are often empty or full!

Dynamic Solution to the Commuter Problem

Set-up:

- Drivers start at Nice Ride Headquarters and use a truck to deliver bikes

Algorithm:

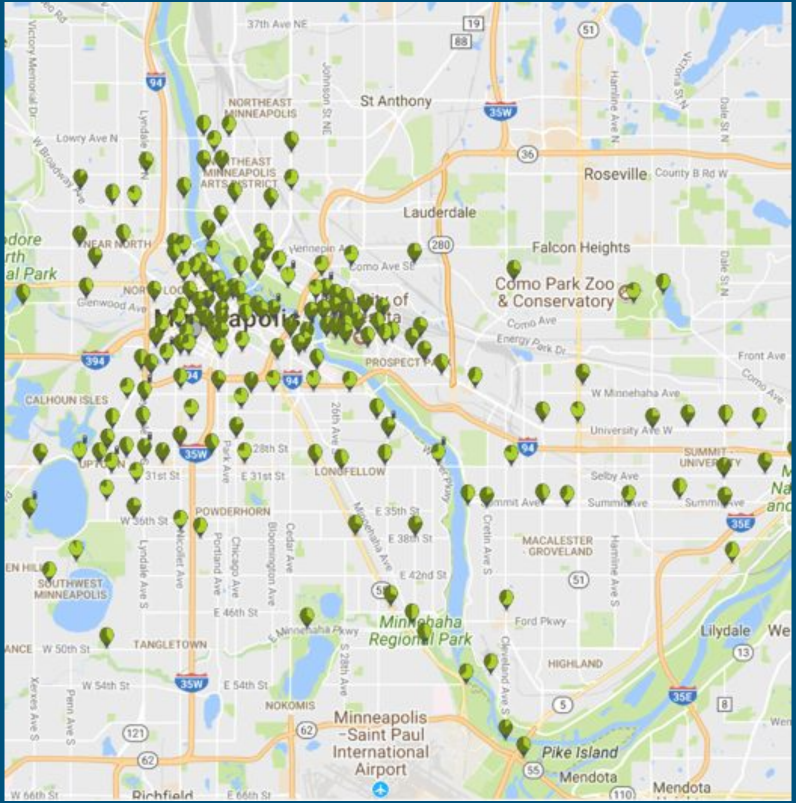
- **Input**: real-time number of bikes and desired number of workers
- **Output:** morning delivery schedule, including bikes needed
  - Rinse and repeat for afternoon and evening

All you have to do is press a button on your laptop!

How Our Algorithm Works

1. Pick a time period during which to deliver bikes (e.g. from 6am to 10am on Monday morning)

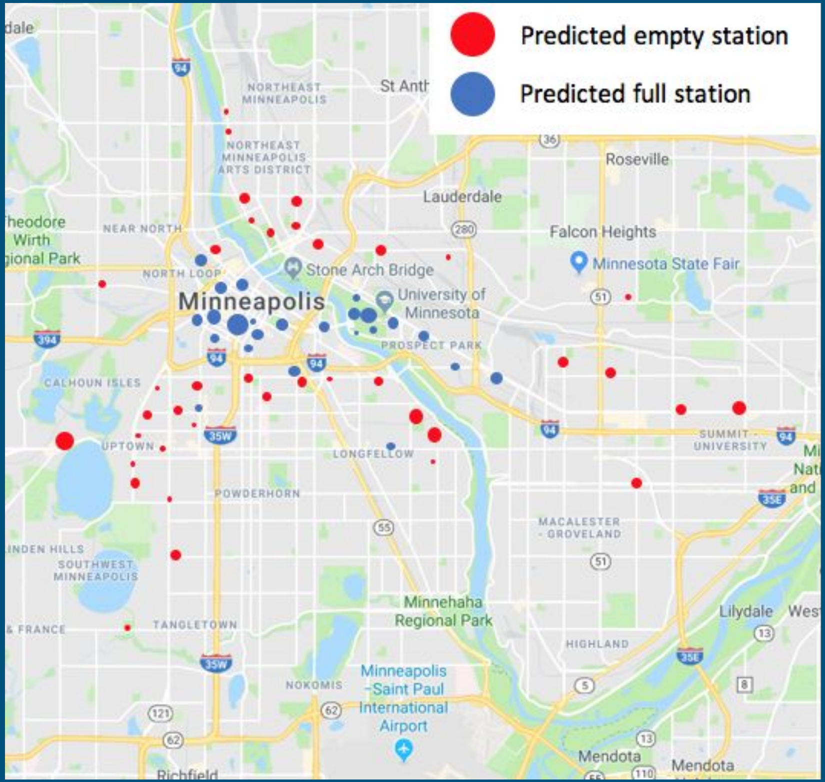
- Pull **<u>real-time number of bikes</u>** at each station at 6am.
  - *Nice Ride already has this data available online*



How Our Algorithm Works

2. **<u>Predict</u>** which stations will have too many or too few bikes at 10 am.

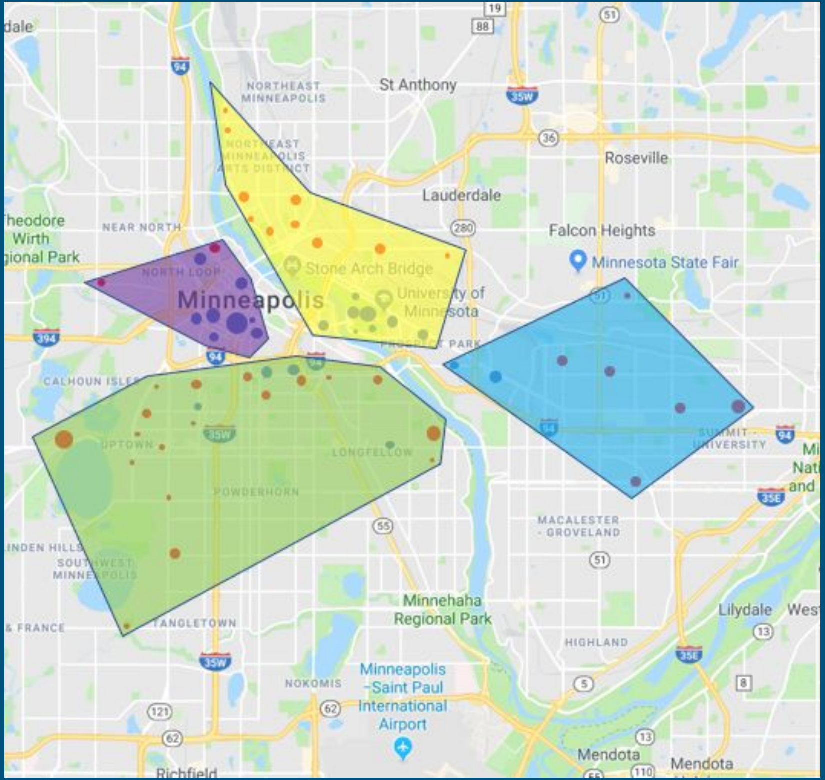
- If this number is lower than 20% or greater than 80% of capacity, the algorithm flags the station and calculates the number of bikes to add or remove.



How Our Algorithm Works

3. **<u>Group</u>** the flagged stations into a delivery zone for each worker.

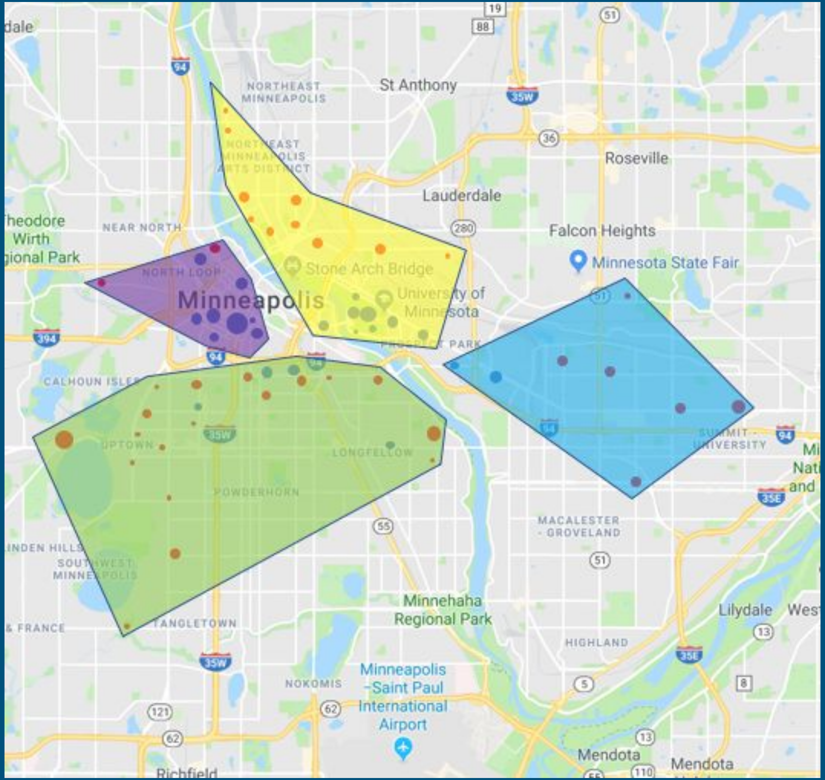
- The algorithm automatically creates zones using k-means clustering
    - Minimizes the distance between stations in a zone.



How Our Algorithm Works

4. **<u>Minimize</u>** distance traveled in each workers' zone and produce **<u>optimal</u>** delivery schedule

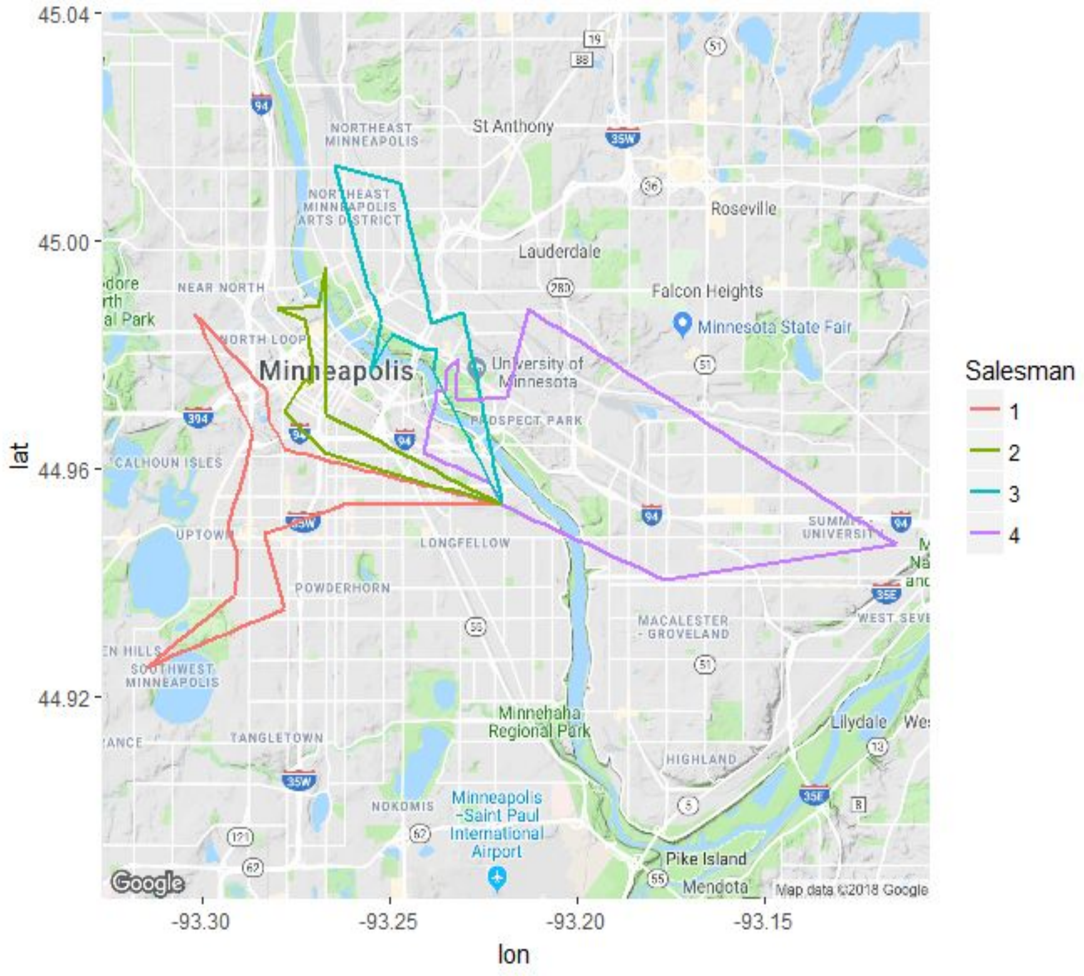
- The algorithm runs the traveling salesman problem
- Produces an optimal delivery schedule in each zone that minimizes distance traveled
    - *Time and cost minimized*



Monday Morning

Example: four vans originating at Nice Ride Headquarters

- Our algorithm produces fully automated morning delivery schedules based on real-time data
- Minimizes time spent by workers
- Maximizes customer satisfaction



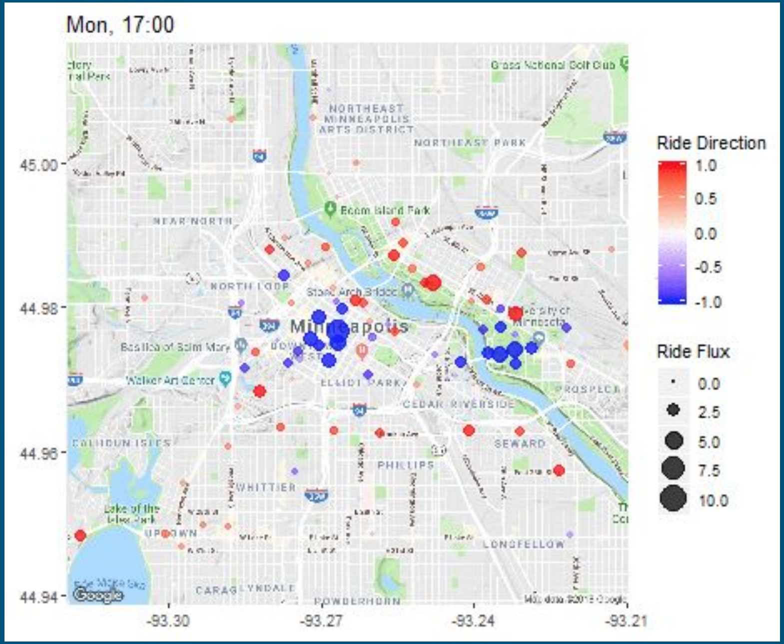
What we bring to the Nice Ride Family

- Our solution represents a significant improvement to the current Nice Ride system

- Can we save money by also implementing long-term solutions that minimize the number of workers needed to deliver bikes?

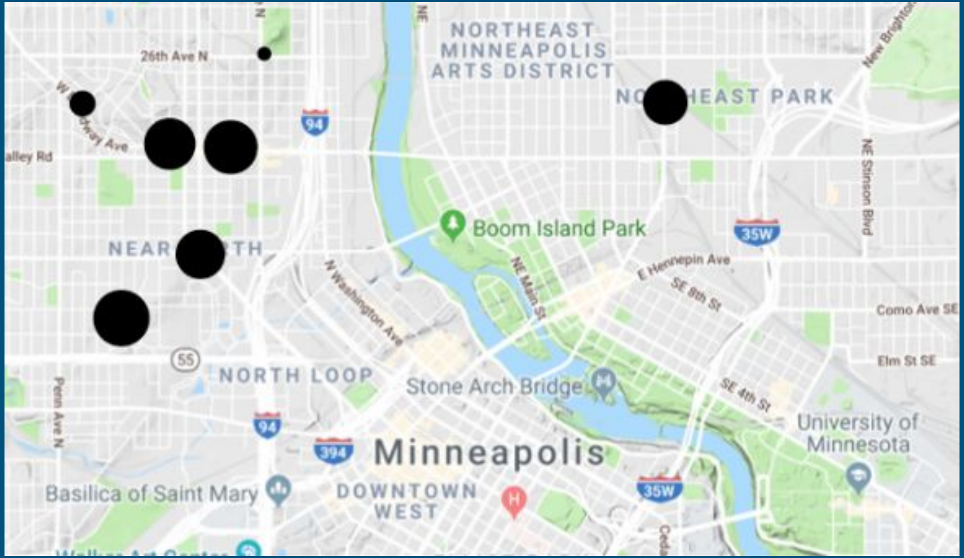
Further Solutions and Areas to Investigate

- Build new stations near high demand areas
  - Investigate expansion around the U of M



Further Solutions and Areas to Investigate

- Build new stations near high demand areas
  - Investigate expansion around the U of M
- Shift docks from low-demand stations (pictured) to high-demand stations



Our Final Recommendations

Action: Implement algorithm to automate bike shuttling

Consequences: Improved customer satisfaction

No stations left empty or full

Fewer worker hours

Future Work: Investigate where to build new stations

Investigate how to reshuffle docks

Thank You!

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Olivia Cannon

Michael Ramsey

Eric Roberts

Elizabeth Wicks

Sheng Zhang

Questions?

Thank You! Questions?

The Fundamental Group:

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